EVA

STS-103 EVA Overview

Calvin Seaman/NASA

EMU Anomaly Status

G. Allen Flynt/NASA
Robert Poisson/HSSSI

STS-103 Flight Readiness Review
Hubble Space Telescope SM-3A

Cal Seaman
EVA Project Office

19 November 1999

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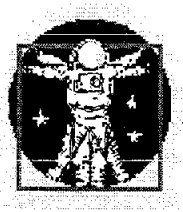

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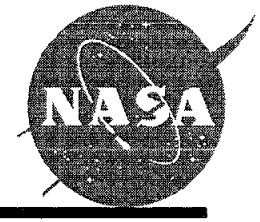
EVA Mission Overview



- **The Objectives of the HST SM-3A Mission are to restore operational science capabilities, to make life extending changes, and to improve Hubble's productivity.**

- **STS-103 Launch Date: 6 December 1999**

- **Mission requirements will support a maximum of six, two-crewmember EVAs:**
  - **Four scheduled EVAs to accomplish HST Mission Objectives**
  - **One unscheduled HST EVA to resolve deployment anomalies**
  - **One contingency EVA for the Orbiter**

- **Flight Crew: Curt Brown (CDR), Scott Kelly (PLT), Steve Smith (P/L CDR-EV1), John Grunsfeld (EV2), Mike Foale (EV3), Claude Nicollier (EV4), Jean-Francois Clervoy (RMS)**

- **HST SM-3A task difficulty is comparable to SM1 and SM2. (i.e. Many of the EVA tasks are similar or identical to those performed in the past: fine guidance sensor, rate sensor units, solid state recorder)**

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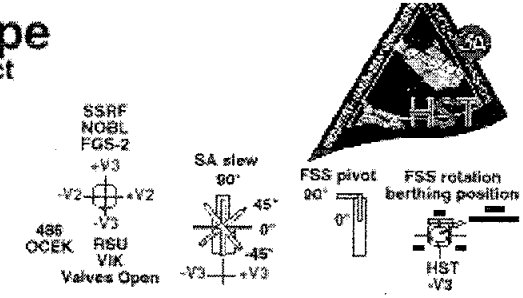
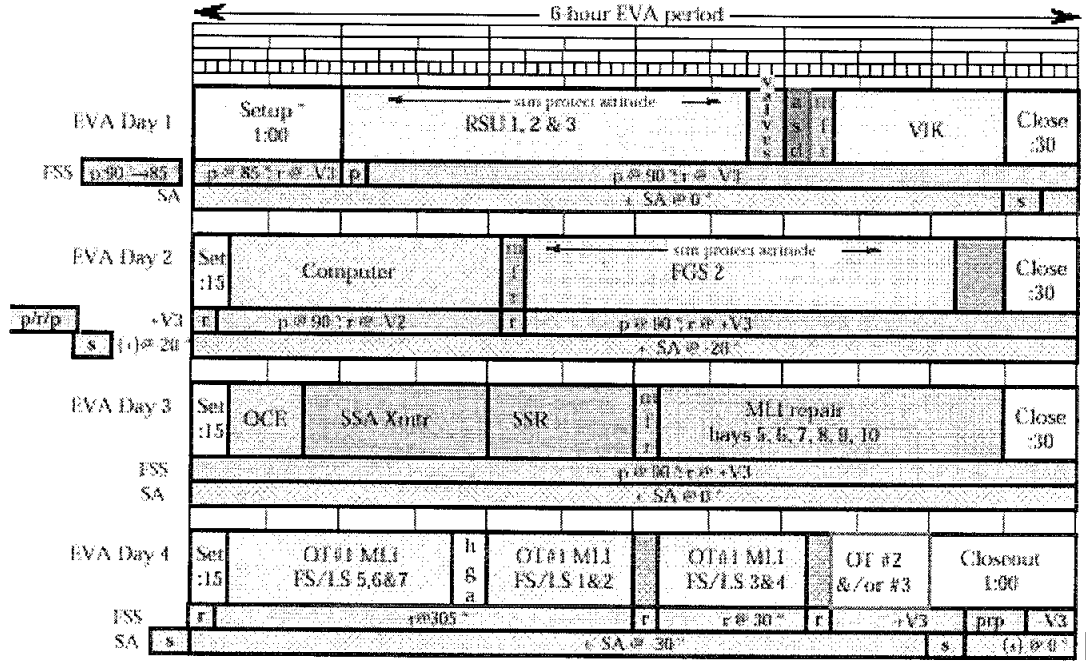
EVA Timeline Summary

Hubble Space Telescope
Flight Systems and Servicing Project

Goddard Space Flight Center

HST SM3A EVA Scenario
FSS p/r/p and SA slew prior to EVA 2 airlock depress
with FSS rotation to -V2 after depress





Baselined Tasks & Priorities

1. RSUs (RSU-1, -2, -3)
2. VIK
3. 486 Computer
4. FGS (FGS-2)
5. SSAT (SSAT-2)
6. SSR (ESTR-3)
7. Bay 5-10 MLI Repair
8. NICMOS valves open

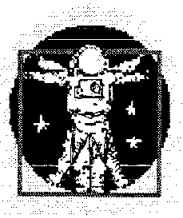
Optional Tasks & Priorities

OT#1. FS/LS MLI Repair
OT#2. Handrail Covers
OT#3. ASLR for +V2 Doors

Required Setup	Task Times
Setup	1:00 (1st day)
	0:15 (mid day)
Closeup	0:30 (mid day)
	1:00 (last day)

* Includes BAPS Post installation
asd – aft shroud door latch contingency
mfr – crew change positions in manipulator foot restraint
hga – high gain antenna deployment

RM August 12, 1999



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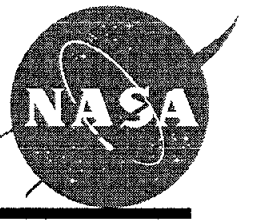
Potential EVA Impacts due to Gyro #1 Failure



- **The November 13 failure of Gyro #1 had an unusual signature which may have been caused by the failure of an Electronics Control Unit (ECU) rather than the Rate Sensor Unit assembly**
- GSFC is working to isolate the failure and a decision is expected November 18
  - **One contingency ECU is currently manifested, and GSFC is planning to add a second ECU for middeck stowage**
- **GSFC may request that the ECU replacement task be added to the mission**
- **JSC has prepared a plan to modify the EVA timeline to add the ECU task to either EVA day #1 or EVA day #3**

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EVA Crew Training

- **EVA training will be completed on 23 Nov 99**
  - **Two final NBL training events are scheduled for 22-23 Nov 99**

- **Total NBL hours: 264**
  - **Overall training ratio: 11 : 1**
  - **Exceeds normal 10 : 1 ratio due to additional training resulting from mission delays**

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EVA Hardware

- **Major EVA Hardware Requirements:**
  - **Four enhanced EMUs with sizing ring kits (Middeck - 3L & 1XL)**
  - **4000-series EMU gloves (2 sets for each EV crewmember)**
  - **Manipulator Foot Restraint (Bay 10-Port)**
  - **HST Portable Foot Restraint (Bay 13-Port and GSFC FSS)**
  - **Port and Starboard Light Weight Tool Stowage Assemblies**
  - **Long EVA slidewire configuration (Port and Starboard)**
  - **Sill-mounted Portable Foot Restraint (Bay 2-Port TSA location)**
  - **Forward Bulkhead Portable Foot Restraint (Normal stowage location)**

- **The STS-103 EVA Support Equipment List (ESEL), Rev 6 is approved**
  - **11 Middeck lockers are being used for unique EVA tool stowage**

- **The STS-103 EMU ESEL, Rev 3 is approved**
  - **6 Middeck lockers are being used for EMU stowage**

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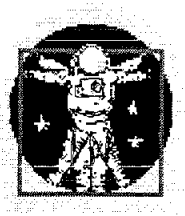

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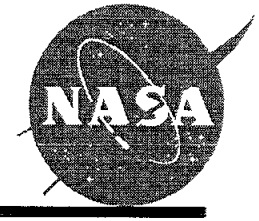
EVA Hardware Issues / Resolutions



- **EVA Winch leaf spring failure/disposition**
  - **Issue resolved: 27 Oct 99 (Discussed at ORMR)**
- **Manipulator Foot Restraint (MFR) latch repair**
  - **Issue resolved: 1 Nov 99 (Discussed at ORMR)**
- **Space Shuttle Program electrical wiring inspection status**
  - **No issues or changes required to EMU wiring (Discussed at Pre-FRR)**
- **55-foot safety tether spring failure**
  - **Issue identified on 16 Nov 99**
  - **Failure investigation/resolution plan currently in work**
  - **A replacement, low cycle, tether reel will be installed in OV-103 on 19 Nov 99**
  - **Exception closure will be presented at the noon board following conclusion of the failure investigation**

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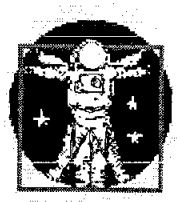

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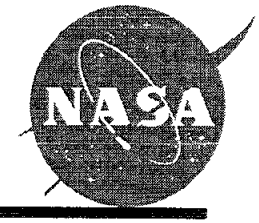
Fit Check and Sharp Edge Status



- The STS-103 ESEL contains:
  - 285 EVA Tools and Crew Aids
    - 126 JSC-provided items
    - 159 GSFC-provided items
  - 49 GSFC ORU's / related items
- Tool-to-Tool fit checks for STS-103 are <u>100% complete</u>:
  - 2500 total fit checks were performed (includes all flight tools and spares)
  - 1244 "required" fit checks (flight tools only)
- Interface-to-Interface fit checks for STS-103 are <u>100% complete:</u>
  - 1844 fit checks performed
- Sharp edge inspections:
  - Complete for ORUC, FSS, Bay 10 and Bay 13 carriers
  - Final payload bay sharp edge inspection planned for completion after payload installation at the pad
- All STS-103 hardware is certified for flight and all CEIT Squawks have been closed

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Readiness Statement

- The EVA Project Office has identified one CoFR exception which must be dispositioned prior to flight:
  - 55-foot safety tether spring failure
- This issue will be closed no later than L-2

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Manager, EVA Project Office

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EMU Anomalies Opened Since STS-93

EVA Project Office
G. Allen Flynt
November 19, 1999

Summary

- **There are no STS-103 flight constraints due to recent Failures / Anomalies**
- **Rigorous pre-flight screens, tests, and inspections are in place to isolate failures prior to flight**
  - EMU Life Support System (LSS) is certified to 15 years and Space Suit Assembly (SSA) softgoods are certified to 8 years
  - STS-103 LSS hardware age ranges between 5 to 9 years
  - STS-103 SSA hardware age ranges between 2 to 4 years
- **49 EMU failures have occurred since the STS-93 FRR**
- **The 49 failures are reduced to 21 relevant failures for STS-103**
  - Each failure occurrence is documented and reported as a unique failure although root cause is the same
    - 4000 Series Glove - 6 occurrences (5 repeats)
    - Enhanced Brief - 3 occurrences (2 repeats)
  - Of the remaining 42:
    - 4 failures are unique to the NBL environment with no flight impact

	49
	-5
	-2
	42
	-4
	38

Summary

- Of the remaining 38, 17 failures are associated with configurations not flying on STS-103 — 38
  - 6 Phase VI glove certification failures(no Phase VI gloves on 103) — -6
  - 1 ORU Hard Upper Torso (HUT) Thermal Micrometeoroid Garment (TMG) failure (no ORU HUT on 103) — -1
  - 1 Liquid Cooling Ventilation Garment (LCVG) Gore-Tex thumb loop (flying nylon thumb loop on 103) — -1
  - On-orbit adjustable waist (no adjustable waist on 103) — -1
  - 8 Positive Pressure Relief Valves (duplicate occurrences, also) — -8
    - different curing process for seats than the STS-103 hardware
- 21 failures are relevant to configurations flying on STS-103 — 21
  - All STS-103 hardware has successfully passed preflight inspections, tests, and other screens designed to detect these conditions
  - Of the 21 failures, 3 were directly related to hardware now manifested on STS-103:
    - Space Suit Assembly Power Harness - Fabric Sheath over cable that powers heated glove temporarily snagged on arm bracket
    - 4000 Series Glove - Glove Gimbal Swivel and Pivots exhibited minor galling during visual inspection. Passed functional.
    - EVA Position Switch - Molded potting material separated from microswitch. Potting material does not need to be adhered to switch.
  - Conclusion: There are no STS-103 flight constraints due to these 21 anomalies, and they are closed — -21

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CoFR EXCEPTION FORM

EXCEPTION NUMBER:	ELEMENT: Safety Tether SED33105087-313 SERIAL NUMBER:	STS FLT NUMBER: STS-103

REQUIREMENT/DESCRIPTION OF EXCEPTION:

Endorsement: Acceptability of unexplained anomalies, problems and IFA's

Exception: The Extended-Range Crewmember (ERCM) safety tether manifested on STS-99 experienced a spring failure on 11/16/99. Results of the failure investigation and the resolution plan is forthcoming.

INITIATOR/TITLE:	DATE:
Calvin Seaman, STS-103 EVA IPT Flight Lead	11/18/99
CONCURRENCE/TITLE:	DATE:
Gregory J. Harbaugh, Manager, EVA Project Office	11/18/99
ACTION/ACTIONEE:	DUE DATE:
REVIEW BOARD CHAIR:	DATE:

RESOLUTION OF EXCEPTION:	DATE RESOLVED:

CONTRACTOR MANAGER:	DATE:	NASA PROJECT MANAGER:	DATE:
SPACE SHUTTLE PROGRAM			DATE:

SSP Form 4043 (Rev Jan 97)